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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/690,782	10/21/2003	Jin-Hyuk Lee	9903-071	5611

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EXAMINER	
GRAYBILL, DAVID E	

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 11/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/690,782	LEE ET AL.	
	Examiner	Art Unit	
	David E. Graybill	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 September 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-20* is/are pending in the application.

4a) Of the above claim(s) *13-16* is/are withdrawn from consideration.

5)☒ Claim(s) *11 and 12* is/are allowed.

6)☒ Claim(s) *1,3-10 and 17-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

The amendment to the claims filed on 9-16-5 does not comply with the requirements of 37 CFR 1.121(c) because the amendment to claim 1 is not made by rewriting the entire claim with all deletions. Amendments to the claims filed on or after July 30, 2003 must comply with 37 CFR 1.121(c) which states:

> (c) *Claims*. Amendments to a claim must be made by rewriting the entire claim with all changes (*e.g.*, additions and deletions) as indicated in this subsection, except when the claim is being canceled. Each amendment document that includes a change to an existing claim, cancellation of an existing claim or addition of a new claim, must include a complete listing of all claims ever presented, including the text of all pending and withdrawn claims, in the application. The claim listing, including the text of the claims, in the amendment document will serve to replace all prior versions of the claims, in the application. In the claim listing, the status of every claim must be indicated after its claim number by using one of the following identifiers in a parenthetical expression: (Original), (Currently amended), (Canceled), (Withdrawn), (Previously presented), (New), and (Not entered).
>
> (1) *Claim listing.* All of the claims presented in a claim listing shall be presented in ascending numerical order. Consecutive claims having the same status of "canceled" or "not entered" may be aggregated into one statement (*e.g.*, Claims 1-5 (canceled)). The claim listing shall commence on a separate sheet of the amendment document and the sheet(s) that contain the text of any part of the claims shall not contain any other part of the amendment.
>
> (2) *When claim text with markings is required.* All claims being currently amended in an amendment paper shall be presented in the claim listing, indicate a status of "currently amended," and be submitted with markings to indicate the changes that have been made relative to the immediate prior version of the claims. The text of any added subject matter must be shown by underlining the added text. The text of any deleted matter must be shown by strike-through except that double brackets placed before and after the deleted characters may be used to show deletion of five or fewer consecutive characters. The text of any deleted subject matter must be shown by being placed within double brackets if strike-through cannot be easily perceived. Only claims having the status of "currently amended," or "withdrawn" if also being amended, shall include markings. If a withdrawn claim is currently amended, its status in the claim listing may be identified as "withdrawn—currently amended."

> (3) *When claim text in clean version is required.* The text of all pending claims not being currently amended shall be presented in the claim listing in clean version, *i.e.*, without any markings in the presentation of text. The presentation of a clean version of any claim having the status of "original," "withdrawn" or "previously presented" will constitute an assertion that it has not been changed relative to the immediate prior version, except to omit markings that may have been present in the immediate prior version of the claims of the status of "withdrawn" or "previously presented." Any claim added by amendment must be indicated with the status of "new" and presented in clean version, *i.e.*, without any underlining.
>
> (4) *When claim text shall not be presented; canceling a claim.*
>
> (i) No claim text shall be presented for any claim in the claim listing with the status of "canceled" or "not entered."
>
> (ii) Cancellation of a claim shall be effected by an instruction to cancel a particular claim number. Identifying the status of a claim in the claim listing as "canceled" will constitute an instruction to cancel the claim.
>
> (5) *Reinstatement of previously canceled claim.* A claim which was previously canceled may be reinstated only by adding the claim as a "new" claim with a new claim number.

Because the response appears to be bona fide, but through an apparent oversight or inadvertence the response is non-compliant, and in order to continue to afford applicant the benefit of compact prosecution, the requirement to comply with the response within a one month time limit is waived, the amendment is entered, and the claims are examined on the merits.

The following is a quotation of the second paragraph of 35 U.S.C. 112:
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 5 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

There is insufficient antecedent basis for the following language:

Claim 5, "the concave portion inside the convex portion."

In the rejections infra, generally, reference labels are recited only for the first recitation of identical claim elements.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 3-10 and 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamaguchi (6780748) and Chu (6400021).

At column 7, lines 13-24 and column 11, line 35 to column 12, line 5, Yamaguchi discloses the following:

A method for a wafer level chip scale package (CSP), the method comprising: providing a semiconductor wafer 10, the semiconductor wafer including semiconductor chips 11 having chip pads 1 and a passivation layer 22a, the wafer further including scribe lines (illustrated in FIG. 5 (a), not labeled) between the chips; forming a first patterned dielectric layer 22b on the passivation layer that exposes the chip pads; forming a second patterned dielectric layer 25 on the first patterned dielectric layer to expose the chip pads; forming an embossed a portion on the second patterned dielectric layer (abutting ball pad 2) including a concave portion that exposes a portion of the first patterned dielectric layer where a ball pad 2 is to be formed and a convex portion that is formed from the second patterned dielectric layer; forming a metal wiring layer 3 on the first and second patterned dielectric layers including the portion, the metal wiring layer being electrically connected to the chip pads; forming a third dielectric layer 26 on the metal wiring layer; and removing a portion of the third dielectric layer over the portion to form a connection hole "areas above the bump pads 2" therein, the connection hole exposing a portion of the metal wiring layer to form the ball pad; forming a solder ball 12 on the ball pad; and cutting the semiconductor wafer along the scribe lines "dicing"

A method for a wafer level chip scale package (CSP) comprising: providing a semiconductor wafer, the semiconductor wafer including semiconductor chips each having chip pads and a passivation layer; forming a first dielectric layer on the passivation layer; patterning the first dielectric layer to expose the chip pads; forming a second dielectric layer on the patterned first dielectric layer; and patterning the second dielectric layer to expose the chip pads, forming a portion on the second patterned dielectric layer; forming a concave portion in the portion that includes an exposed portion of the first dielectric layer where a ball pad is to be formed; and forming a convex portion in the portion of the second dielectric layer; forming a metal wiring layer on the first and second patterned dielectric layers, the metal wiring layer being electrically connected to the chip pads; forming a third dielectric layer on the metal wiring layer; and removing a portion of the third dielectric layer over the non-planar surface to form a connection hole therein, the connection hole exposing a portion of the metal wiring layer over the non-planar surface to form a ball pad; forming a solder ball on the ball pad.

However, Yamaguchi does not appear to explicitly disclose an embossed portion on the second patterned dielectric layer including a concave portion that exposes a portion of the first patterned dielectric layer where a ball pad is to be formed and a convex portion that is formed from

the second patterned dielectric layer; forming an embossed portion on the second patterned dielectric layer; forming a concave portion in the embossed portion that includes an exposed portion of the first dielectric layer where a ball pad is to be formed; and forming a convex portion in the embossed portion of the second dielectric layer wherein the convex portion is contained within the concave portion; wherein the convex portion is bounded by substantially vertical side walls and wherein said method further includes forming a ball pad on the concave portion, the convex portion, and the walls.

Nonetheless, at column 4, lines 13-18; column 4, line 57 to column 5, line 4; and column 5, lines 54-59, Cho discloses an embossed portion 30, 32 on the second patterned dielectric layer 30 including a concave portion 32 that exposes a portion of the first patterned dielectric layer 20 where a ball pad 51 is to be formed and a convex portion (defined by 32, illustrated in FIG. 6, not labeled) that is formed from the second patterned dielectric layer forming an embossed portion on the second patterned dielectric layer; forming a concave portion in the embossed portion that includes an exposed portion of the first dielectric layer where a ball pad is to be formed; forming a convex portion in the embossed portion of the second dielectric layer; wherein the convex portion is contained within the concave portion; wherein the convex portion is bounded by substantially vertical side walls and

wherein said method further includes forming a ball pad on the concave portion, the convex portion, and the walls. Moreover, it would have been obvious to combine this disclosure of Cho with the disclosure of Yamaguchi because it would strengthen the adhesion force between the solder ball 12 and pad 2.

Also, Yamaguchi and Cho do not appear to explicitly disclose wherein the concave portion comprises a circle shape, and the convex portion has an annular shape; wherein the convex portion comprises a discontinuous ring shape; wherein an area of the concave portion inside the convex portion is approximately equal to an area of the convex portion; wherein forming a first patterned dielectric layer comprises exposing a portion of the passivation layer inside the ring-shaped second dielectric layer; wherein forming a second patterned dielectric layer comprises exposing a portion of the passivation layer inside the ring-shaped second dielectric layer.

Nonetheless, as cited, Cho discloses wherein forming a patterned dielectric layer 30 comprises exposing a portion of the passivation layer 20 inside the dielectric layer. Furthermore, it would have been obvious to combine this disclosure of Cho with the disclosure of Yamaguchi because it would strengthen the adhesion force between the solder ball 12 and pad 2.

In addition, as reasoned from well established legal precedent, it would have been an obvious matter of design choice bounded by well known

manufacturing constraints and ascertainable by routine experimentation and optimization to choose the particular claimed dimensions because applicant has not disclosed that, in view of the applied prior art, the dimensions are for any additional purpose, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Claims 3, 4, 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamaguchi and Cho as applied to claim 2, and further in combination with Peng (6444295).

Yamaguchi and Cho do not appear to explicitly disclose wherein the concave portion comprises a circle shape, and the convex portion has an annular shape; wherein the convex portion comprises a discontinuous ring shape; wherein forming a first patterned dielectric layer comprises exposing a portion of the passivation layer inside the ring-shaped second dielectric layer; wherein forming a second patterned dielectric layer comprises

exposing a portion of the passivation layer inside the ring-shaped second dielectric layer.

Still, at column 3, lines 19-47; and column 4, lines 11-13, Peng discloses wherein the concave portion (of 320, illustrated in FIG.2(a), not labeled) comprises a circle shape "ring," and the convex portion (of 320, illustrated in FIG.2(a), not labeled) comprises a ring shape and having a smaller diameter than the concave portion; wherein the convex portion comprises a discontinuous ring shape (each concentric ring is discontinuous with another ring).

To further clarify, the convex portion comprises a ring shape and having a smaller diameter than the concave portion when the convex portion is concentric with and within the concave portion.

Moreover, it would have been obvious to combine this disclosure of Peng with the disclosure of the combination of Yamaguchi and Cho because it would facilitate the provision of the concave and convex portions of Yamaguchi and Cho and increase the firmness of the ball bond.

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamaguchi and Chu as applied to claim 19 supra, and further in combination with Yunus (20030234447).

Yamaguchi and Chu does not appear to explicitly disclose wherein the convex portion comprises a plurality of arcuate portions, each having

substantially vertical end walls and wherein the ball pad is also formed on the end walls.

Nevertheless, at paragraph 57, Yunus discloses wherein the convex portion 904 comprises a plurality of arcuate portions 904, each having substantially vertical end walls and wherein the ball pad 904 is also formed on the end walls. Furthermore, it would have been obvious to combine this disclosure of Yunus with the disclosure of Yamaguchi and Chu because it would enable gas venting during solder reflow of the ball of Yamaguchi.

Claims 11 and 12 are allowed.

Applicant's remarks filed 9-16-5 have been fully considered and are addressed supra and infra.

Applicant contends that layer 50 of Cho does not include a convex portion.

This contention is respectfully traversed because the prior art is not applied for a disclosure that layer 50 includes a convex portion.

Applicant also traverses the rejection: "In addition, as reasoned from well established legal precedent, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose the particular claimed dimensions because applicant has not disclosed that, in view of the applied prior art, the dimensions are for any additional purpose,

and it appears prima facie that the process would possess utility using another dimension," because, "Applicant's claim limitations, however, define shapes that substantially increase the contact area of the ball with the metal over those shapes shown in the prior art."

This traversal is respectfully deemed unpersuasive because applicant does not disclose that, in view of the applied prior art which discloses shapes that substantially increase the contact area of the ball with the metal, the dimensions are for any additional purpose; nor has applicant disclosed that, in view of the applied prior art which discloses shapes that substantially increase the contact area of the ball with the metal, the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the

advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

For information on the status of this application applicant should check PAIR: Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Alternatively, applicant may contact the File Information Unit at (703) 308-2733. Telephone status inquiries should not be directed to the examiner. See MPEP 1730VIC, MPEP 203.08 and MPEP 102.

Any other telephone inquiry concerning this communication or earlier communications from the examiner should be directed to David E. Graybill at (571) 272-1930. Regular office hours: Monday through Friday, 8:30 a.m. to 6:00 p.m.
The fax phone number for group 2800 is (571) 273-8300.

David E. Graybill
Primary Examiner
Art Unit 2822

D.G.
19-Nov-05